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Differentiation and social segregation of UK higher education, 1996-2010

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January 2013

Abstract

Policies to expand higher education (HE) in the UK have emphasised the importance of widening participation by under-represented groups. However, the attention has shifted from who participates in HE (and who does not) to the different institutions attended by students from different backgrounds. Researchers have typically investigated this issue by comparing rates of entry to different types of university. This paper proposes an alternative approach; it uses concepts of social segregation, hitherto applied mainly to secondary schools, to analyse UCAS data on the social and demographic characteristics of entrants to HE. It estimates indices of segregation between HE institutions, and between subject areas within institutions, for selected cohorts of entrants to full-time undergraduate courses between 1996 and 2010. Levels of segregation during this period have been relatively high in relation to ethnicity and independent schooling, lower in relation to age and lowest in relation to gender, disability and social class. Most indices show stability over time, with a decline in the segregation of non-white ethnic groups and a small increase in segregation of independent school students. Levels of segregation differ across the four UK home countries, and tend to be highest in England.

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Introduction

In the UK as elsewhere the under-representation of less advantaged social and demographic groups in higher education (HE) has been a matter of continuing policy concern. However, as HE has expanded, 'there has been a shift in the focus of attention ... from a concentration upon who goes and who does not go to university to questions about "who goes where?"' (Reay, David and Ball 2005, 162). Partly as a result, strategies for widening participation have placed increasing emphasis on the policies and practices of individual universities. Institutions are encouraged to engage in outreach activities to raise aspirations, to develop new pathways into HE, to adopt recruitment strategies which may widen participation, to introduce 'fair admissions' procedures, to offer bursaries, fee waivers and other forms of financial support, and to organise their programmes in a way to attract members of under-represented groups. They are set benchmarks or targets for the composition of their student body and their progress towards these targets is measured.

Inequalities in participation in HE as a whole can largely be explained by the different qualifications of applicants from different backgrounds (Gorard et al. 2007). However, similarly qualified candidates from different backgrounds tend to apply to, and enter, different institutions (Forsyth and Furlong 2000; Chowdry et al. 2008). In many countries the level of social inequality in overall participation has declined as higher education has expanded, but the more disadvantaged groups have increased their participation mainly in second-tier institutions. These institutions may be the means both of the 'inclusion' of under-represented groups in HE but also of their 'diversion' away from higher-status pathways (Shavit, Arum and Gamoran 2007; Iannelli, Gamoran and Paterson 2012). The concept of 'maximally maintained inequality' suggests that under-represented groups increase their participation as HE expands, but that the already advantaged groups increase their participation even more, and only when the latter approach saturation point do inequalities begin to decline (Raftery and Hout 1993). The theory of 'effectively maintained inequality' predicts that even this decline may be illusory, as inequalities become manifested in the different institutions or programmes in which people participate rather than in the difference between participation and non-participation (Lucas 2001). Much recent research on widening participation in the UK has focused on relative rates of entry to higher- and lower-status institutions, with the former variously defined as Oxbridge, the Russell Group universities, the 'Sutton 13' or 'Sutton 30' (Sutton Trust 2011; Sutton Trust and BIS 2009), pre-1992 universities or, in Scotland, the 'ancient' universities founded before 1600.

In this paper we use indices of social segregation to illuminate the institutional differentiation of HE. Segregation indices are low if groups are proportionately distributed across institutions, and high if they are concentrated in particular institutions. Theories of effectively maintained inequality would predict an increase in segregation over time. Segregation indices have been used to analyse social differentiation in a variety of contexts including the residential segregation of ethnic groups, gendered occupations, and polarised income patterns. In educational research they have hitherto been applied mainly to school education. In this paper we aim to demonstrate that they are also relevant to current issues in HE.

An advantage of social segregation indices is that they allow levels of segregation to be compared - between countries, between dimensions of inequality (social class, ethnicity, etc)

and over time. A further advantage is that they do not rely on assumptions about institutional hierarchies. Not only may hierarchies change, making the measurement of trends problematic, but actual differentiation processes may be more complex and multi-dimensional than a single hierarchy could convey. We therefore need to understand institutional *differentiation* within HE and not merely its hierarchical *stratification*. Students choose universities (or are chosen by them) for a variety of reasons, not all of which can be represented in terms of their hierarchical differences, but which may nevertheless lead to the over- or under-representation of groups in particular institutions. Students may be influenced by a range of factors including location, reputation, the choices and recommendations of peers, the ability to study while remaining in the family home, opportunities for employment during study and perceived costs of study, as well as the content, quality and vocational relevance of the chosen programme (Gorard et al. 2007; Purcell et al. 2008; Mangan et al. 2010). Reay, David and Ball (2005, 94) analyse the choice of institution in terms of the 'synchronisation of familial and institutional habitus': students choose institutions where they have a 'sense of belonging'. If institutions' habitus are becoming more diverse, we would expect to find increased segregation with respect to characteristics associated with this sense of belonging.

Segregation indices may also inform wider debates about the institutional differentiation or diversity of HE. A recurring debate in the UK and elsewhere has concerned the extent to which the functional and quantitative expansion of HE (that is, the increase in the range of roles it is expected to perform as well as the increase in its scale) does or should lead to greater institutional specialisation (Trow 1974; Williams and Fry 1994; Scott 2008). Teichler (2007, 99) describes an 'expansion and diversification' theory which was influential in public debates at the end of the twentieth century. According to this theory 'the expansion of HE creates a pressure for diversification because the needs of the learners and other potential users of the services of higher education become more varied and because, as many actors believe, these varied needs might be more readily met through a certain "division of labour" among institutions'. Teichler contrasts this with 'flexibilisation' theories which argue that rigid divisions of labour are inefficient and vulnerable to change, and 'drift' theories which predict convergence towards academic institutional missions. Huisman, Meek and Wood (2007) note that there is limited empirical evidence on institutional diversity in HE, and especially on trends. They suggest that the variation across institutions in the socio-economic status of students might provide a measure of diversity. Segregation indices provide such a measure. To the extent that diversity of institutional missions leads to diversity of student composition, expansion and diversification theories would predict an increase in segregation over time, whereas flexibilisation and drift theories would predict a decrease.

The questions we explore are:

1. How segregated (dissimilar) are UK HE institutions, and subject groups within institutions, in their intake of different social and demographic groups?
2. Has segregation changed over the period 1996-2010?
3. Has segregation differed across the home countries of the UK?

Segregation

Social segregation is important for school education because segregated systems lead to polarised outcomes and stronger links between socio-economic status and life chances (Gorard 2009). A pupil's performance is influenced by the social composition of the school as well as by his or her own social background (Willms 1997); in a segregated system disadvantaged pupils face the double disadvantage of a negative school-composition effect as well as the influence of their own disadvantaged background. Evidence from the Programme for International Student Assessment (PISA) shows that "[s]econdary school systems with large social differences between schools tend on average to have worse results in mathematics and reading and a greater spread of reading outcomes. Social background is more of an obstacle to educational success than in systems where there are not large socio-economic differences between schools" (Field et al. 2007).

In the 1990s there was considerable debate as to whether the development of school markets, and in particular increased parental choice, had caused schools to become more polarised in terms of the ability and socio-economic status of their intakes. Qualitative research found that higher social-class parents had exercised the opportunity to choose a particular school more than lower social-class parents, and that they tended to choose schools with strong academic reputations and high average socio-economic status (Gewirtz et al. 1995; Willms 1997). However, large-scale quantitative analyses of school segregation in terms of children living in poverty (as measured by entitlement to free school meals) found, contrary to expectations, that schools in England and Wales became less segregated in the 1990s; the researchers suggested that the initial advantage of high social-class families in exercising school choice was merely a 'starting-gun' effect, and that subsequently lower social-class families used the opportunity of school choice to move their children away from the low-achieving schools to which residential segregation would otherwise restrict them (Gorard, Taylor and Fitz 2003). These findings provoked debates about the appropriate measurement of segregation (Gibson and Asthana 2000; Goldstein and Noden 2003, 2004). Allen and Vignoles (2007) subsequently re-analysed the Annual Schools Census data for the years 1989-1995, using a number of different segregation indices, and confirmed the findings of Gorard, Taylor and Fitz (2003) that nationally segregation between schools fell during this period, although the trends varied between local authorities. They identified further local differences between 1999 and 2004, with segregation rising in 60% of local authorities and falling in 40%.

Croxford and Paterson (2006) used survey data to compare trends in social-class segregation between secondary schools in England, Wales and Scotland from 1984 to 1999; their analysis found no clear upward or downward trajectory in the period since parental choice was introduced, but showed consistently lower segregation in Scotland than in England, which they attributed to Scotland's more comprehensive secondary school system.

Social segregation also inhibits social cohesion if schools do not adequately prepare their students for adult life in a culturally and ethnically diverse society. Burgess and Wilson (2005) found high levels of ethnic segregation in England's schools in 2001, with considerable variation across local authorities and across different ethnic groups. High ethnic segregation between schools coincided with areas that experienced rioting in summer 2001. Segregation was higher for pupils of Indian, Pakistani or Bangladeshi origin in areas where

they were relatively numerous, whereas segregation was lower for pupils of black Caribbean or black African heritage in areas where they were more numerous.

In this paper we apply segregation indices to HE, and we use them primarily to measure institutional differentiation, a concept with no precise analogy in secondary education, although some theoretical issues such as effectively maintained inequality may refer to either level of education. Nevertheless, many of the considerations which make segregation indices relevant to schools apply similarly to HE institutions. As we have seen, these indices have been used to monitor the effects of the development of school markets; they similarly offer a promising way to monitor the effects of the marketisation of HE in England. It is likely that the student peer group within universities affects attainment and future social cohesion in much the same way as it does in schools. It shapes the opportunities for acquiring social capital and may consequently affect the subsequent employment chances of students.

One difference between universities and schools is their relative size and internal heterogeneity. The composition of all fellow-students in a university may be a poor indication of the characteristics of those with whom a given student will interact. Compared to students at the same school, students in the same university may vary more with respect to their study habits, their residential patterns, their employment commitments and other factors which affect how they interact with each other. There are, in other words, important dimensions of segregation *within* HE institutions that are likely to be associated with contextual effects on learning or social cohesion, and these will not be reflected in measures of segregation based on institutions. However, segregation indices can take account of some of these dimensions of segregation, such as the tendency for different HE subject areas to attract students from different backgrounds. For example, ethnic minority and working-class applicants to university are relatively likely to choose programmes closely connected to employment (Forsyth and Furlong 2000; Chowdry et al. 2008; Purcell et al. 2008). In their analyses of school differences Dronkers, van der Velden and Dunne (2012) address a similar issue by treating programmes-within-schools as separate units of analysis. In this paper we calculate two sets of segregation indices: one based on institutions, and the second based on subject areas within institutions, treating each subject area as if it were an autonomous institution.

Segregation Indices

Indices of (un)evenness: D and GS

Different indices measure different aspects of segregation, including evenness, exposure, concentration, centralisation and clustering (Massey and Denton 1988; Allen and Vignoles 2007). Indices of (un)evenness are most relevant to our analysis of institutional differentiation. (Un)evenness is defined as the extent to which an institution's share of minority and majority students deviates from the 'fair share' they would have if minority and majority students were distributed evenly across institutions. The most commonly used index of (un)evenness is the Index of Dissimilarity (D), which represents the percentage of one group or the other which would have to move if there was to be no segregation

between the groups. D is calculated using formula 1 in Figure 1 and is based on a symmetrical comparison of the distribution of minority and majority groups across institutions. For each institution the calculation compares the proportion of the whole minority population entering that institution, with the proportion of the whole majority population entering that institution, and the value of the index is half the summation of these institutional differences. A value of zero would represent no segregation – all groups evenly spread across institutions. A value of one or 100% would represent a completely segregated system in which students from minority groups did not enter the same institutions as students from majority groups.

[Figure 1 about here]

There has been debate concerning the advantages and disadvantages of D (Gorard and Taylor 2002; Allen and Vignoles 2007). The debate focuses first on the principle of ‘composition invariance’: the index should be unaffected by scaling of columns or rows through an increase in the raw figures which leave the proportions otherwise unchanged. In other words, if the size of the minority group increases but the increased numbers are evenly spread across institutions there should be no increase in the segregation index. Gorard and Taylor (2002) argue that D has weak composition invariance; they advocate an alternative index of segregation termed GS (Figure 1 formula 2) based on the difference between the proportion of a minority group in an institution and the proportion of all group members in the same institution. They argue that GS is strongly composition invariate, but recognise that a possible objection to GS is that it is not symmetrical, so the formula gives different answers for the minority group A and for the majority group B.

Allen and Vignoles (2007) disagree on the relative advantages and disadvantages of D and GS. They argue that D is indeed composition invariate, and that unlike GS it has the additional advantage that it is symmetrical. It is bounded by 0 and 1, which means that estimates can be related to concepts of complete segregation or complete integration. They note that in effect the GS index is calculated by shrinking the dissimilarity index (D) by a factor of $1-p$, where p is the overall proportion of the minority group in the population, thus giving it a variable upper limit of $1-p$. The corollary, which Gorard (2007) notes, is that D is simply the sum of GS based on group A and GS based on group B. While debating the properties of their preferred indices, Allen and Vignoles (2007) and Gorard (2009) agree that D and GS show broadly similar downward trends in segregation between schools.

Indices of isolation (I)

Indices of isolation are conceptually linked to the effects of segregation on social cohesion; they measure the extent to which members of a minority group are exposed only to each other, and thus isolated from members of its complementary group. They are quite different from indices measuring unevenness, because they are influenced by the size of the minority group: although members of a group could be unevenly distributed across institutions, if their numbers were small they would not necessarily be isolated. The isolation index is calculated using formula 3 in Figure 1. Burgess and Wilson (2005) use both D and I to explore ethnic segregation in England’s schools because they provide different perspectives on segregation. We report measures based on I below, but even from the perspective of social cohesion a symmetrical index such as D may be superior: social cohesion is affected

just as much when majority group members have no contact with the minority group as when minority group members are isolated.

We present initial results using D, GS and I, but for analyses involving subject areas and comparisons across the UK we focus on (un)evenness as the most appropriate representation of institutional differentiation. We use D rather than GS to measure (un)evenness because it is bounded by 0 and 1, making it possible to compare different minority groups, whereas GS would have different upper bounds for each minority group. D has the further advantage of being symmetrical so that, for example, the index for male is the same as for female.

Data

The analysis uses administrative data from the Universities and Colleges Admissions System (UCAS) covering six cohorts of entrants to full-time undergraduate programmes in UK institutions in 1996, 2000, 2004, 2006, 2008 and 2010. We identify as entrants all applicants who were formally accepted for a place through UCAS, including those accepted through clearing. The UCAS data do not tell us if all these acceptances were followed through to entry to, and continuation on, the course; nor do they cover people who made successful direct applications to institutions after the UCAS clearing process was completed. Ideally our analysis would have covered all entrants to HE, part-time as well as full-time, and whether at a university or a college of further education (FE). However the UCAS data do not cover part-time programmes and only a small number of FE colleges are members of UCAS, so our analysis is restricted to full-time participation at HE institutions (see Croxford and Raffe 2011a). An analysis which included college-based and part-time programmes might have found higher levels of segregation. UCAS data have limitations when used for research purposes (Gorard et al 2007; Hoelscher and Hayward 2008), but these are balanced by their UK-wide coverage and population data on the groups which are included.

The number of applicants through UCAS to HE institutions rose by 67% between 1996 and 2010, and the number of entrants rose by 65% (Croxford and Raffe 2011a). These trends are partly affected by institutional restructuring, with some non-HE institutions achieving university status and others merging with existing HE institutions. UCAS also became responsible for applications to new HE subjects such as nursing. Participation increased most in the new universities which achieved university status from 1992 onwards; their entrants increased by 88% between 1996 and 2010 compared with 41% in Russell Group universities and 64% in other pre-1992 universities.

We use data on the social, demographic and educational backgrounds of entrants that are collected by UCAS during the application process. Table 1 shows the percentage of entrants with each attribute, the percentage with missing information and the population size. (Cases with missing information are excluded from the data on which the segregation indices are based). Information about sex, age and domicile are available for almost all entrants, and Table 1 shows change over time in these characteristics: the proportion of entrants who were male declined over the period from 50% to 45%, while 'mature' students, aged 21 or over, comprised 23% of the cohort both at the beginning and at the end of the period. The proportion of entrants who were not UK-domiciled increased from 9% to 13%.

[Table 1 about here]

The next panel of Table 1 shows variables which were available, and relatively complete, only for UK-domiciled applicants. There was a slight increase in the proportion of entrants reporting a disability, although this may be an artefact of changes in the reporting of learning difficulties such as dyslexia. The most substantial change was the rise in the proportion of entrants from non-white ethnic groups, from 12% to 19%. Within the non-white category, the percentage of entrants who were black doubled whereas the percentage from Asian backgrounds changed relatively little.

The third panel of Table 1 is restricted to UK-domiciled entrants aged under 21; the equivalent information for older age groups either has more missing information or is collected on a different basis. Students from independent schools have high participation rates in HE because of their higher average prior attainment and possibly for other reasons such as access to more focused careers advice (Sutton Trust and BIS 2009). Nevertheless, the proportion of entrants coming from independent schools declined from 14% to 10%. Information about social class is derived from an optional question in the UCAS application form which asked under-21s to state the occupation of the parent, step-parent or guardian 'who earns the most'. Their responses were coded into the Registrar General's (RG) classification in 1996 and 2000 and the National Statistics Socio-Economic Classification (NS-SEC) from 2004 onwards. We have simplified the RG classification and the seven-class version of NS-SEC to produce the four 'social classes' shown in Figure 2. In calculating segregation indices we exclude those who have missing or inadequate data; these comprised a significant fraction of the under-21 cohort, ranging from 6% in 1996 to 20% in 2008. We refer to the classes shown in Figure 2 as classes 1 to 4, but they are not comparable across the change in classification, so in Table 1 trend comparisons are only possible between 1996 and 2000 or over the period 2004-2010. Neither period shows much change. Between 2004 and 2008 there was a small increase in the proportion of entrants from social class 4, from 18% to 20%, but this fell back slightly to 18% in 2010.

[Figure 2 about here]

Segregation between HE institutions

Table 2 shows the series of segregation indices derived from UCAS data on entrants. Each index is based on a dichotomous variable which distinguishes members and non-members of the relevant group (for example male vs. female, black vs. all other ethnic groups, social class 4 vs. social classes 1-3). Numbers in each group are totalled for each HE institution and for UK HE entrants as a whole, and the indices constructed using the formulae in Figure 1. Segregation indices are calculated as proportions, which in Table 2 have been multiplied by 100 and converted to percentages for ease of reading.

[Table 2 about here]

The first panel of Table 2 shows indices of dissimilarity (D). A value of 100 for D would represent total segregation, and a value of 0 represents complete integration. Between

these limits, values up to 30 are considered to be low, 30-60 moderate, and 60 and above are high (Burgess and Wilson 2005).

The first row of Table 2 shows low values of D for males (11 in 1996 and 9 in 2010), suggesting that throughout the period males and females were fairly evenly spread across institutions. By contrast, the index of dissimilarity for over-21s has been a little higher, at around 25 throughout the period; this confirms that mature students were not evenly distributed across institutions, and that this pattern did not change over time. The value of D for non-UK entrants shows a steady increase over time, from 24 in 1996 to 32 in 2010. This confirms that non-UK students have not been evenly spread across HE institutions, and they have become more concentrated in particular institutions over the period: a possible consequence of the diversification of institutional missions.

The low levels of D for entrants with reported disabilities shows that they have been fairly evenly spread across HE institutions; however, it should be noted that this measure embraces a wide range of disabilities, including less visible disabilities such as dyslexia. The much higher figure for non-white entrants demonstrates their uneven distribution, with clustering in certain institutions, but there was a slight decline in segregation over the later part of the period. The level of segregation was highest for black entrants in 1996, but it declined fairly steadily over the period, from 55 to 46. Levels of segregation of entrants of Asian origin were slightly lower, and showed a different trajectory; they rose to a high point of 45 in 2004 and fell slightly thereafter, although the fall in segregation of Pakistani/Bangladeshi students was limited.

Segregation indices for social class and independent schools refer only to the under-21 age group. They confirm that entrants from independent schools have been unevenly spread across HE institutions: D was moderately high in all years and increased from 38 to 44 between 1996 and 2006, levelling off thereafter. We produce three estimates of social-class segregation corresponding to the three cut-off points in our four-class scale: (1) class 1 compared with classes 2-4, (2) class 1-2 compared with 3-4 and (3) class 4 compared with 1-3. None indicates very high levels of segregation, and - allowing for the change of classification - there are no clear upward or downward trends over time. The social class variable is based on less detailed questions than would be asked in a typical social survey, and it is acknowledged by researchers and by UCAS itself to be unreliable (Harrison et al 2011). There are substantial numbers of cases with missing information (Table 1). Estimates of segregation based on this variable are therefore likely to be downwardly biased. Nevertheless, the variable shows face validity in other analyses, and it is unlikely that its unreliability accounts for the low values of D for social class in Table 2, which are lower than most estimates of school segregation for social class, free-school-meal entitlement or similar measures. They are considerably lower than segregation indices for ethnicity in Table 2, and (perhaps more remarkably) they are considerably lower than the indices for independent schools.

The second panel of Table 2 shows indices based on Gorard's segregation index (GS). These are a little lower than D but they show very similar trends over time. The highest levels of segregation are found for non-white ethnic groups and entrants from independent schools. There was a very strong downward trend in levels of segregation of black entrants, but the trends in segregation for Asian groups were initially upward to a peak in 2004, with

subsequent small decline. There was a clear upward trend in the segregation of entrants from independent schools between 1996 and 2006, which levelled off thereafter.

The third set of indices in Table 2 show the index of isolation (I) which measures the probability that any random encounter between entrants of an HE institution will be between members of the same minority (or comparison) group. This measure is strongly influenced by the size of the group in question. For example, the isolation index for males is very high, because the population of males is large, and there is a high probability that another student randomly encountered by a male student would also be male; nevertheless, the isolation index for males declined from 51 to 46 over the period as more females entered higher education, and the probability that a random encounter would be with a female student increased. The highest isolation indices relate to students from professional and managerial social classes. In 2010 58% of their random interactions were estimated to occur within their own class, but since they comprised 57% of all students with known social class this is not very remarkable. The isolation index is of more interest for groups that are small in number. For example, students from independent schools comprised 16% of under-21 entrants in 1996, falling to 12% from 2006 onwards, but their isolation was greater because of their clustering in institutions: the probability of one independent school entrant randomly encountering another at her/his HE institution was 26% in 1996, falling to 22% in 2010. The isolation index for non-white entrants was, similarly, much higher than their proportion in the population, due to their clustering in institutions. It was also much higher than the indices for specific ethnic groups, because it refers to a larger group. The index for non-whites increased from 29 in 1996 to 36 in 2006, and then fell back slightly to 35 in 2010. This increase occurred despite the fall in levels of D for non-white students, and reflects their growth in numbers: non-whites increased from 12% to 20% of the total number of entrants with known ethnicity.

Segregation by subject area within institution

Our second set of segregation indices, presented in Table 3, treats each subject area within each institution as if it were a separate institution. This is based on seven subject areas: medicine and veterinary medicine; subjects allied to medicine; sciences; engineering and technology; social science, business and law; arts; and combined subjects. Given our conceptual preference for indices of dissimilarity, discussed earlier, and the fact that D and GS produced similar findings in the earlier analysis, the following analyses report estimates for D only. The same substantive findings emerge whichever index is used.

[Table 3 about here]

Since there are well-documented gender differences between subjects (Croxford 2000, Purcell et al. 2008), it is not surprising that levels of gender segregation are higher when subject areas as well as institutions are taken into account. D for males ranges from 27 in 1996 to 25 in 2010, compared with 11 and 9 respectively when dissimilarity is measured only between institutions (Table 2). Estimates for the segregation of over-21s are also higher, possibly reflecting a tendency for mature students to concentrate in particular subject areas. This tendency appears to have increased over time: D for over-21s rose from 27 in 1996 to 32 in 2010 – whereas the corresponding D between institutions only stayed fairly level,

fluctuating between 24 and 26. There was a similar increase in the concentration of non-UK entrants in particular subjects-within-institutions.

Estimates of D for disability and ethnicity are slightly larger when based on subjects within institutions than when based on institutions alone. However, the differences between the two sets of D are much smaller than for gender, age and domicile. The differences between the two sets of D are even smaller in relation to our last set of estimates, for independent schools and social class. These are much the same when based on subjects within institutions as when based on institutions only.

Differences between the UK home countries

The UK's four education systems have different characteristics and contexts that may affect their levels of segregation (Croxford and Raffe 2011b; Raffe and Croxford 2012). We therefore recalculate selected segregation indices separately for each home country (Table 4). Because of the relatively small number of separate institutions in Scotland, Wales and Northern Ireland we calculate these indices only for subjects within institutions. As we have seen in Table 3, for most of the variables we are studying segregation indices based on subjects within institutions are similar in magnitude to indices based on institution alone. However, one implication of this approach is that in the systems with fewest institutions - and especially in Northern Ireland - the indices may be affected more by differences between subject areas than by differences between institutions.

[Table 4 about here]

The dissimilarity indices for over-21s were a little higher in England than in Scotland, but in both systems they showed an upward trend (27 and 23 respectively in 1996 rising to 33 and 30 in 2010); in both systems mature students were increasingly concentrated in particular institutions and subject areas. In Wales the index rose from 25 in 1996 to a peak of 35 in 2004 (higher than England or Scotland) and thereafter fell to 31 in 2010. Indices were lowest in Northern Ireland throughout the period.

Levels of segregation of non-white entrants were considerably higher in England than in the other home countries. The numbers of non-white entrants were also considerably higher in England, so this may suggest a 'compositional' effect on the index as argued by Gorard and Taylor (2002); however, results using the Gorard index show broadly similar differences and trends. Levels of segregation of non-white entrants showed a slight decline from 47 in 1996 to 43 in 2010 in England, and also fell in Wales and Scotland; in Northern Ireland they were very low in 1996 and 2000 but increased in later years to match the levels in Wales and Scotland. The differences between home countries in patterns of segregation of black and Asian minority groups were similar to those for the non-white group as a whole. The highest levels of segregation were for black students in England, where D fell from 54 in 1996 to 47 in 2010. Indices for sub-groups in Northern Ireland are not shown because of small numbers.

The home countries' segregation indices for entrants from independent schools diverged over the period. In 1996 the indices for England and Scotland were the same (39); thereafter the index for England increased to 46 in the late 2000s, but in Scotland it rose to a peak of 41 in 2000 and then fell gradually to 36. The Scottish trend appears to reflect the decline in the proportion of entrants from the rest of the UK, many of whom were from independent

schools and tended to concentrate in a small number of universities. If the Scottish indices are recalculated for Scottish-domiciled entrants only, they show a slight increase in segregation over the period, from 32 in 1996 to 34 in 2000 and 35 in 2010. In Wales the indices of segregation of independent school students were lower than in England or Scotland throughout the period, but showed an upward trajectory similar to that in England. In Northern Ireland there were too few entrants from independent schools to give meaningful results.

Segregation indices for social class were relatively low in all four home countries. They were highest in England and lowest in Northern Ireland, but the country differences were much lower than in relation to ethnicity. Levels of social-class segregation do not show clear upward or downward trajectories.

Discussion

Earlier in this paper we posed three broad research questions. The first asked about the level of segregation of UK HE institutions, and of subject areas within institutions, with respect to the social and demographic characteristics of their intakes. We used measures of unevenness or dissimilarity to answer this question, and we applied these to institutions and to subject areas within institutions. Except for characteristics that are strongly related with subject choice, such as gender and non-UK domicile, the answers were broadly similar for the two approaches. However, they varied substantially according to the student characteristic concerned. Levels of ethnic segregation within UK HE have been much higher than levels of social-class segregation, and ethnic segregation has been high both for Asians and for blacks. These findings lead us to question the current policy preoccupation with social class: if institutional segregation is the criterion, ethnic inequalities are far more substantial. Of course, ethnic segregation may partly reflect factors that are beyond institutions' control, such as residential segregation and the desire of some ethnic minorities to stay in the family home while studying (Purcell et al. 2008). But in most parts of the UK non-white applicants to HE are more likely than white applicants to choose institutions *outside* their home region, where they would not normally be able to stay at home (Raffe and Croxford 2012). Ethnic segregation may also reflect variations in institutional habitus and in ethnic groups' 'sense of belonging' to particular institutions. The policy implications are not simple: should we celebrate the success of particular institutions in attracting ethnic-minority entrants, or regret that these entrants are reluctant to consider other institutions?

Former independent-school pupils have been considerably more segregated than students from any of the four social classes. This may challenge the common view that independent schooling is a proxy for social class in analyses of unequal access; if independent school leavers cluster in particular universities perhaps that needs to be addressed as an issue in its own right. Of the other variables examined, we have found low levels of segregation for gender and disability, somewhat higher levels for mature (over 21) students, and fairly high levels for non-UK entrants. The recruitment of mature students and of non-UK students is probably less subject to central policy influence than that of most other groups discussed here, and in these cases segregation may reflect a diversity of institutional missions.

Our second question asked about change over the period 1996-2010. For the most part we found segregation to be remarkably stable over the period. There was a decline in segregation of non-white students, and especially of black students, and this trend occurred

over a period when the proportion of non-white entrants increased more than other social groups; contrary to the predictions of 'effectively maintained inequality', increased participation was not offset by increased segregation. Levels of social-class segregation remained stable, at a relatively low level; this occurred over a period when participation rose among all classes but the class composition of entrants remained relatively stable, as far as we can judge from our data. On the other hand, the segregation of former independent-school pupils increased, at a time when they declined as a proportion of all entrants. This at least appears to be consistent with the predictions of 'effectively maintained inequality'. The increase in the segregation of non-UK entrants may reflect one aspect of the diversification of institutional missions, and provides some support for the expansion and diversification theory. However, our most significant finding is that institutional differentiation remained generally stable over a period of expansion, institutional restructuring and policy change.

Our last question asked about differences across the home countries of the UK. Levels of segregation have been generally higher in England than in the other countries, probably reflecting the larger scale and greater institutional diversity of its HE system. This parallels the findings of research on school segregation, which show higher levels of segregation in England than in Scotland (Croxford and Paterson 2006). However, in HE the country differences have been much larger in respect of ethnic segregation than of social-class segregation; the relatively high level of ethnic segregation of English students must be set against the much larger proportion of students in England who are non-white, and the relative propensity of non-white students in Scotland, Wales and Northern Ireland to apply to universities in England (Raffe and Croxford 2012).

Finally, we conclude that the segregation indices do indeed offer a powerful tool for analysing institutional differentiation within HE systems, and for making comparisons across dimensions of inequality, between countries and over time. The analyses presented here cover a period of considerable change in UK HE; we hope that in due course they may be updated to explore the consequences of the further social, institutional and policy changes currently under way.

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Figure 1: Definitions of segregation indices

<i>(Un)even-ness:</i>	
1. Dissimilarity (D)	$D=0.5*\sum(A_i/A-B_i/B)$
2. Gorard's index (GS)	$GS=0.5*\sum(A_i/A-T_i/T)$
<i>Isolation:</i>	
3. Isolation/Exposure (I)	$I=\sum(A_i/A).(A_i/T_i)$
<p>Where:</p> <p>A_i is the number of minority-group entrants in institution i B_i is the number of majority-group entrants in institution i T_i is the total number of entrants in institution i A is the total number of minority-group entrants in all institutions B is the total number of majority-group entrants in all institutions T is the total number of entrants in all institutions</p> <p>Source: Gorard and Taylor (2002); see also James and Taeuber (1985) and Massey and Denton (1988).</p>	

Figure 2 Social class categories by cohort

class	1996, 2000 cohorts	2004,2006,2008,2010 cohorts
1	RG I: professional	NS-SEC 1: Higher managerial and professional,
2	RG II: managerial and technical	NS-SEC 2: Lower managerial and professional
3	RG IIIN: skilled non-manual	NS-SEC 3 and 4: Intermediate, small employers and own-account workers
4	RG IIIM, IV and V: manual	NS-SEC 5, 6 and 7: Routine and manual: lower supervisory and technical, semi-routine and routine

Table 1. Percentage of entrants with each characteristic by cohort

		1996	2000	2004	2006	2008	2010
All entrants	male	50	47	47	46	45	45
	aged 21 or over	23	20	22	21	23	23
	non-UK domiciled	9	9	12	12	12	13
	N (=100%)	290196	327913	364077	377846	442117	464384
UK-domiciled	with reported disability	4	4	5	5	6	6
	non-white	12	13	16	18	18	19
	• black	3	3	4	5	6	6
	• asian (all groups)	9	10	10	10	9	9
	→ Pakistani/ Bangladeshi	3	3	3	4	4	4
	→ Indian	4	5	4	4	4	3
	Missing ethnicity	5	7	6	5	5	2
	N (=100%)	262935	297079	321499	332586	390608	402615
UK-domiciled under-21s	From independent school	14	12	12	11	11	10
	<i>Missing school type</i>	10	10	10	8	8	11
	Social class 1	(17)	(15)	21	20	18	20
	Social class 2	(42)	(42)	28	26	24	26
	Social class 3	(11)	(11)	19	18	17	17
	Social class 4	(24)	(24)	18	18	20	18
	<i>Missing social class</i>	(6)	(8)	14	18	20	19
	N (=100%)	205382	242903	260088	268575	306762	315930

Table 2. Indices of segregation between UK HE institutions

	1996	2000	2004	2006	2008	2010
Dissimilarity index						
D_male	11	9	10	10	9	9
D_over-21	24	25	26	25	26	25
D_non-UK domiciled	24	26	28	29	32	32
D_disabled	9	11	11	11	14	10
D_nonwhite	45	45	45	44	43	42
D_black	55	51	48	48	45	46
D_asian	41	43	45	43	41	40
D_pakistani/bangladeshi	44	45	47	45	45	44
D_indian	44	44	46	45	43	40
D_independent school	38	42	43	44	44	44
D_social class 1	(20)	(21)	18	20	21	20
D_social class 1-2	(18)	(18)	17	18	17	17
D_social class 4	(19)	(19)	19	20	18	19
Gorard segregation index						
GS_male	6	5	5	5	5	5
GS_over-21	19	20	20	19	20	19
GS_non-UK domiciled	22	23	24	25	28	28
GS_disabled	9	10	11	11	13	9
GS_nonwhite	39	38	37	36	34	33
GS_black	53	49	46	46	43	43
GS_asian	38	38	40	38	37	36
GS_pakistani/bangladeshi	42	43	45	43	43	43
GS_indian	42	42	44	43	42	38
GS_independent school	32	36	37	39	39	39
GS_social class 1	(17)	(18)	14	15	16	15
GS_social class 1-2	(7)	(7)	7	8	8	7
GS_social class 4	(14)	(14)	15	15	14	15
Isolation index						
I_male	51	48	48	47	46	46
I_over-21	28	26	27	27	28	28
I_non-UK domiciled	13	13	16	17	17	19
I_disabled	5	4	5	6	11	7
I_nonwhite	29	33	34	36	36	35
I_black	14	13	13	15	15	16
I_asian	18	21	22	21	20	18
I_pakistani/bangladeshi	6	8	10	10	10	10
I_indian	9	11	11	11	9	7
I_independent school	26	24	24	23	23	22
I_social class 1	(20)	(19)	27	27	26	28
I_social class 1-2	(64)	(63)	59	58	55	58
I_social class 4	(29)	(29)	24	25	28	25

Table 3. Dissimilarity indices for subject areas within UK HE institutions

	1996	2000	2004	2006	2008	2010
D_male	27	26	24	24	25	25
D_over-21	27	28	30	30	32	32
D_non-UK domiciled	36	34	37	38	41	41
D_disabled	13	16	16	16	18	14
D_nonwhite	49	49	48	48	46	46
D_black	56	53	50	51	49	49
D_asian	47	48	49	48	46	45
D_pakistani/bangladeshi	49	51	52	50	50	49
D_indian	50	50	50	50	48	45
D_independent school	39	43	44	46	46	45
D_social class 1	(21)	(22)	19	21	21	20
D_social class 1-2	(19)	(19)	18	19	18	18
D_social class 4	(21)	(20)	20	21	19	20

Table 4. Selected dissimilarity indices for subject areas within HE institutions in each home country

		1996	2000	2004	2006	2008	2010
D_over-21	England	27	29	30	29	33	33
	Wales	25	26	35	32	32	31
	N_Ireland	15	18	16	16	15	16
	Scotland	23	28	29	29	30	30
D_non-UK domiciled	England	37	35	37	38	41	42
	Wales	31	29	34	32	37	37
	N_Ireland	30	25	26	27	24	30
	Scotland	33	35	38	33	34	36
D_non-white	England	47	47	46	46	45	43
	Wales	29	29	24	22	23	22
	N_Ireland	12	14	21	17	21	21
	Scotland	23	24	20	22	21	19
D_black	England	54	50	47	48	46	47
	Wales	33	35	30	28	34	36
	N_Ireland	*	*	*	*	*	*
	Scotland	35	38	39	40	37	34
D_asian	England	45	46	46	45	44	42
	Wales	35	38	29	31	32	28
	N_Ireland	*	*	*	*	*	*
	Scotland	28	31	29	29	27	26
D_independent school	England	39	43	44	46	46	46
	Wales	25	29	32	32	33	31
	N_Ireland	*	*	*	*	*	*
	Scotland	39	41	39	37	39	36
	scottish domiciled	32	34	32	33	34	35
D_social class 4	England	(21)	(20)	20	21	20	20
	Wales	(18)	(17)	15	16	14	16
	N_Ireland	(13)	(14)	11	10	13	14
	Scotland	(20)	(19)	18	19	15	18
<i>Number of institutions</i>	<i>England</i>	<i>135</i>	<i>130</i>	<i>134</i>	<i>134</i>	<i>134</i>	<i>136</i>
	<i>Wales</i>	<i>15</i>	<i>15</i>	<i>14</i>	<i>14</i>	<i>13</i>	<i>12</i>
	<i>N_Ireland</i>	<i>2</i>	<i>3</i>	<i>5</i>	<i>4</i>	<i>4</i>	<i>4</i>
	<i>Scotland</i>	<i>19</i>	<i>18</i>	<i>19</i>	<i>19</i>	<i>18</i>	<i>18</i>
<i>Number of subject within HEI units</i>	<i>England</i>	<i>614</i>	<i>628</i>	<i>614</i>	<i>623</i>	<i>629</i>	<i>635</i>
	<i>Wales</i>	<i>63</i>	<i>62</i>	<i>64</i>	<i>64</i>	<i>61</i>	<i>60</i>
	<i>N_Ireland</i>	<i>12</i>	<i>14</i>	<i>20</i>	<i>17</i>	<i>17</i>	<i>17</i>
	<i>Scotland</i>	<i>95</i>	<i>99</i>	<i>102</i>	<i>105</i>	<i>99</i>	<i>99</i>
<i>Number of entrants</i>	<i>England</i>	<i>236136</i>	<i>269160</i>	<i>298219</i>	<i>312673</i>	<i>368503</i>	<i>387604</i>
	<i>Wales</i>	<i>17403</i>	<i>18221</i>	<i>20351</i>	<i>21342</i>	<i>23230</i>	<i>24793</i>
	<i>N_Ireland</i>	<i>6058</i>	<i>7953</i>	<i>9581</i>	<i>8569</i>	<i>9824</i>	<i>9751</i>
	<i>Scotland</i>	<i>30599</i>	<i>32579</i>	<i>35926</i>	<i>35262</i>	<i>40560</i>	<i>42236</i>

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